For work group discussion only

Prospector – Key EPA concerns with past studies

Health/Exposure Data

1. The only "health study" I am aware of prior to the June 1988 ATSDR study was performed by the Utah Department of Health - part of a student's thesis. I do not have a copy of the final report. (Unpublished report by Perrotta DM, Stafford WD, Populations exposed to mining/milling wastes. 1986). Blood lead data was collected from 39 children (ages 3-12) potentially exposed to the mine tailings in the Prospector area. Blood lead data was also obtained from 9 children in the Park Meadows area (the comparison area). Data was collected in both April 1984 and October 1984. This was before significant covering of tailings occurred in 1985.

Key Findings

- The average blood lead level for children potentially exposed to the Prospector tailings was higher than the comparison area both in April (9.5 ug/dL vs. 7.5 ug/dL) and October (10.5 ug/dL vs. 9.5 ug/dL). The difference between "exposed" population and comparison population was found not to be statistically significant "due to the small sample size" (presumably in the comparison area). The study design was not randomized.
- Blood lead levels increased in October relative to April in both areas (unsure if this was statistically significant), indicating potential increased exposure during summer months and a seasonal component to exposure. This could be related to snow covering the ground during the winter months and increased outdoor activity during summer – this is symptomatic of environmental exposures but does not exclude other exposure sources.
- All averages were lower than national averages for white children during the period 1976-1980 (approximately 15 ug/dL) as stated in the June 1988 ATSDR report. However, blood lead levels nationally declined *substantially* from 1980 to 1984, and comparison of 1984 levels with 1980 levels is *not* a good indicator, much less 1976. See attached table of national blood lead levels in US for all ages (EST, 1999).
- All levels were lower than the CDC guideline *at the time* of 25 ug/dL, though the average for Prospector in October was higher than the *current* CDC guideline of 10 ug/dL. Also, current guidelines call for no more than a 5 % chance than an individual's blood lead will exceed 10 ug/dL, as opposed to the *average* of the population. This data, if interpreted today, would indicate a potential problem.
- Since I don't have the study, I have no information on levels in specific children, and no information was collected on the lead levels in soils or dust at the specific homes/yards of children living in Prospector (i.e. were children living in Prospector really "exposed" at their specific residence? - there is a great deal of variability in lead levels from yard to yard). If children living in "clean" areas of Prospector were tested and included in the "exposed" group, this could bias the "exposed" population low.

2. ATSDR conducted a health study in 1987, which was *after* Park City took action covering much of the tailings with 6 inches of topsoil in 1985. The report was published in June 1988. Samples were collected only in October. 127 blood samples were collected from residents of all ages in the Prospector area (the target area) and from households in the Park Meadows area (the comparison area). Of these, 51 were from children aged 0-7 years (38 in Prospector vs. 13 in Park Meadows). The study design here was likely much better than the

Key Findings

- Among children 0-7 years, the average blood lead level in the target area (7.8 ug/dL) was higher than in the comparison area (4.0 ug/dL). This difference was found to be statistically significant. This indicates increased exposure to lead in Prospector relative to Park Meadows. Sample size in the control area was again low.
- Among adults, there was no statistical difference between the target area and the comparison area. This potentially indicates children were being exposed differently in Prospector compared to Park Meadows, but adults were not. This trend is often seen with environmental exposures due to increased hand to mouth activity in children compared to adults and increased uptake of lead in children compared to adults.
- Four participants had blood lead levels higher than 15 ug/dL, and one of those (a child) had a blood lead level of 31 ug/dL (1/38 children in target area = 2.6%). This was the only case with a level higher than the CDC guideline *at the time* of 25 ug/dL and was attributed in the study anecdotally (i.e. without strong evidence) to potential exposure to lead solder. It is unclear from the report how many children had a level greater than 10 ug/dL (the *current* guideline). However, the number is certainly higher than the 5% chance considered acceptable today (only one additional child in Prospector would have to have been above 10 ug/dL to meet this criteria [2/38 =5.2%] and four children had levels greater than 15 ug/dL).
- Levels at Prospector in this 1987 study were lower than those observed in 1984, though direct comparison is difficult due to different study designs. This potentially indicates that covering the tailings lowered blood lead levels in Prospector, though blood lead levels nationally were declining in those years also.
- Again, average levels observed were significantly lower in the Prospector area (7.8 ug/dL) than the national average of white children from 1976-1980 (15 ug/dL). However, comparing 1987 data with 1976-1980 data is again inappropriate due to generally declining blood lead levels during that period (i.e. the national average in 1987 was much lower than in 1976-1980 - see attached EST paper). For instance, the EST table reports that average blood leads for all ages in the U.S. in 1976 was 15.9 ug/dL, in 1980 had dropped to 9.5 ug/d, and by 1988-91 was as low as 3 ug/dL. This decline was due to phase out of leaded gas as well as other lead awareness changes.
- Again, no lead concentration (soils, dust) data was available for *individual* residences or yards in Prospector to verify that children tested in the "target" area were actually being exposed. This could bias the "exposed" number low.

TABLE 1. Summary of Studies Containing Data on Lead in Gasoline, Air, and Blood

location	year	blood lead (μg/dL)	lead in gasoline (g/L)	air lead (μg/m³)	population age range	refs
Athens, Greece	1979		0.80	3.2	adults	*17, 18*
	1982	16.0	0.40	1.76		
	1984	11.8	0.22	0.91		
	1988	8	0.15	0.7		
	1993	5.5	0.14	0.43		
Barcelona, Spain	1984	18.6 (±6.6)[a]	0.60	na[b]	20–60	*19*
	1994	8.8 (±6.6)	0.13	0.24 (±0.06)[a]		
Belgium	1979	17.0	0.45	1.05	20+	*20*
	1983	14.7	0.40	0.66		
	1987	9.0	0.15	0.49		
Cape Town, South Africa	1984	9.7 (±4.1)[a]	0.84	na	adults	*21–23*
	1990	7.2 (±3.6)	0.40	na		
Caracas, Venezuela	1986	17.4	0.62	1.9	15+	
	1989	15.2	0.45	1.3		
	1991	15.6	0.39	1.3		
Christchurch, New Zealand	1978–1981	15.2	0.84	na	adults and children	*7–9, 24*
	1982–1983	11.8	0.84	na		
	1984–1985	8.1	0.84	na		
	1989	7.3	0.45	na		
	1994	4.9	0.2	na		
Helsinki, Finland	1983	4.8 (±2.3)[a]	0.35	0.33	children	*25, 26*
	1988	3.0 (±2.3)	0.14	0.095		
	1996	2.6 (1.7–3.7)[c]	0.00	0.007		
Himalayas, Nepal	1980	3.4	0.00	0.004	adults and children	*10, 27*
Landskrona, Sweden	1978	6.0 (1.8–25.0)[c]	0.40	na	3–19	
	1982	4.8 (1.5–10.0)	0.15	na		
	1994	2.5 (1.2–12.3)	0.00	na		
Mexico City, Mexico	1988	12.2	0.2	na	0.5–3	*14, 28–30*
	1989	14.6	0.2	na		
	1990	9.8	0.18	na		
	1991	8.6	0.08	na		
	1992	9	0.07			
	1993	7	0.06			
Ontario, Canada	1984	11.9 (11.3–12.6)[d]	0.30	na	3–6	*31, 32*
	1988	5.1 (4.8–5.4)	0.09	na		
	1990	3.6 (3.3–3.9)	0.04	na		
	1992	3.5 (3.1–3.8)	0.00	na		
Rural Japan	1977–1980	3.8 (± 0.2)	0.00	na	20+	*11*
Stockholm, Sweden	1980	7.7 (± 3.3)[a]	0.40	1.20	adults	*33*
	1983	5.4 (± 3.3)	0.15	0.50		
Switzerland	1984–1985	10.3 (8.0–17.2)[e]	0.15	na	25–74	*34*
	1988–1989	7.3 (5.6–12.7)	0.10	na		
	1992–1993	5.9 (4.4–10.2)	0.05	na		
Tarragona, Spain	1990	12.0 (± 1.8)[a]	0.40	2.0 (0.97–3.26)[c]	6–65	*35*
	1995	6.3 (± 1.8)	0.13	0.23		
Trelleborg, Sweden	1979	5.6 (2.7–10.4)[c]	0.40	na	3–19	*27, 36*
	1983	4.2 (1.9–8.1)	0.15	na		
	1993	2.3 (1.0–6.7)	0.00	na		
Turin, Italy	1980	21	0.6	3	18+	*1, 37*
	1985	15.1 (± 3.9)[a]	0.4	2.3		
	1989		0.3	1		
	1993	6.4 (±1.7)	0.11	0.53		
United Kingdom	1979	12.9	0.42	na	adults and children	*38–40*
	1981	11.4	0.38	na		
	1985	9.5	0.38	0.48		
	1986	8.4	0.14	0.24		
	1995	3.1	0.055	na		
United States	1976	15.9	0.465	0.97	1–74	*2, 6, 41, 42*
	1977	14.0	0.394			
	1978	14.6	0.349			
	1979	12.1	0.306	0.71		
	1980	9.5	0.30	0.49		
	1988–1991	2.8 (2.7–3.0)[d]	0.00	0.07 (0.05–0.12)[d]		

[a] Standard deviation. [b] na, not available. [c] Range. [d] 95% confidence interval. [e] 90% confidence interval.

As can be seen from Figure 1, for a given location there is a strong linear correlation between gasoline lead concentrations and population blood lead levels. For those 13 locations where population blood lead levels were measured at three or more time periods, the relation of blood lead to gasoline lead is largely linear, with a median correlation coefficient, R^2, of 0.94. Results of linear regression analysis for these 13 locations and results of linear fits for all seven-